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GENETIC VARIABILITY AND CORRELATION ANALYSIS FOR YIELD TRAITS IN CHICKPEA (*CICER ARIETINUM* L.)

MUDUGU SOUMYA & GAIBRIYAL. M. LAL

Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and sciences, PRAYAGRAJ, UP

ABSTRACT

This study was conducted at the Genetics and Plant Breeding field testing center, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Science, PRAYAGRAJ for the analysis of genetic variability, correlation and path coefficients in 20 Chickpea germplasm with an unmarried check in Randomized Block design 2020-21 with three replicates. Variance analysis showed tremendous differences among all genotypes and all characters, showing an extra diploma of variability. The maximum GCV was located at the range of pods consistent with plant, observed by using the seed index (19.17) and seeds in keeping with pod (18.30). Whereas for PCV, the variety of pods according to plant (23. Ninety-seven) was recorded, accompanied by means of the seed index (21. Ninety-nine) and biological weight (21. Fifty-five). PCV values have been determined to be better than GCV values, showing that the surroundings have an impact on the characters. Number of seeds consistent with plant (ninety.80) had the best heritability, followed by way of quantity of pods consistent with plant (86.20), range of seeds per pod (83. Ninety), and harvest index (83.Ninety). (83.20). For number of pods per plant, quantity of seeds per plant, 100 seed weight, and biological weight, excessive heritability and genetic development were said, displaying that those parameters are pushed by way of additive gene impact. Simple phenotypical selection through the simple technique of choice will also be green, because of the accumulation of additive genes. Number of principal branches, number of pods consistent with plant, seeds per plant, biological weight, 100 seed weight, harvest index, seed yield on the genotypical level and phenotypic level had been drastically correlated. Number of branches, variety of plant pods, number of plant seeds, organic yield, harvesting index proven direct and nice consequences on both the genotypical and phenotypical levels of seed yield, which exhibited the finest impact on plant yield. Therefore, the choice of yield improvements in chickpea need to receive super weight to those traits.

Keywords: Genetic variability, heritability, genetic progress, correlation, path coefficient, yield, Chickpea. Chickpea (Cicer arietinum L).

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Original Article

INTRODUCTION

The Fabaceae circle of relative's yearly legume, a subfamily of Faboideae, is Chickpea (*Cicer arietinum* L.). It is 2n = 2x = sixteen chromosomes and has a genomic length of 732 Mb. Chickpea can also have come from a place here in south-east turkey. India with 65 percentage of world chickpea manufacturing is the most important chickpea grower in the world. India covers an area of 6. Three million hectares (5.1 million tonnes). Chickpeas had cultivated in an area of nine.93 Mha for 2020-21, manufacturing eleven.35 mt/ha and productiveness 960 kg/ha. The development of crop conditions relies upon the genetic variety of genotypes and heritage additives. For every breeding attempt sought for development, genetic variety is important. Genetic variability can therefore be utilised to pick out suitable parents. Genetic variability is observed inside the form of genotypic differences for several traits within the heterogeneous populace. The success of any breeding endeavour requires statistics on critical genetic

additives and the associated factors of seed manufacturing. (Saurab *et al.,* 2017) The genotypical and phenotypic variation coefficient assesses the size of genotypes and phenotypes as genotypic and phenotypic coefficients of variation, inheritance and genetic improvement play an essential role in enhancing output. Yield is a complicated feature that is stricken by many factors both genetic and environmental, and direct choice might not be effective. The ultimate goal of a breeding programme. The correlation at the side of direction evaluation would consequently help to determine suitable selection criteria to improve yield. The modern-day technique is consequently to assess the genetic variability, coefficient of correlation, direction analysis, and yield contributing functions.

MATERIAL AND METHODS

The experimental materials, which covered twenty genotypes of chickpea and one manage, had been planted on November 7, 2021, at the Department of Genetics and Plant Breeding, SHUATS, Prayagraj. The test was conducted in three replications using a Randomized Block Design with 30 x 10 interrow spacing and a 1 x 1 m plot spacing among plants. To ensure a healthful crop, the counselled programs and techniques have been used. Data for thirteen quantitative functions were accumulated, including days to 50% flowering, days to 50% pod putting, range of primary branches, number of secondary branches, biological weight, and days to maturity. Plant top, pod count number per plant, seed be counted in line with pod, seed depends per plant, harvest index, a hundred seed weight, seed yield in line with plant. On a plot basis, observations on 50 percentage flowering and days to maturity were made, while plant top, number of number one and secondary branches, range of pods according to plant, quantity of seeds in keeping with plant, wide variety of seeds in keeping with pod, organic weight, 100 seed weight, harvest index, and seed yield had been made on five randomly selected plants. According to Fisher's method, the mean statistics of every person had been subjected to evaluation of variance to decide the extent of importance most of the genotypes for wonderful characters (1936). The mean values from replications were used to derive genetic parameters which include GCV and PCV using the technique proposed by using Burton (1952), heritability by way of Burton and Devane (1953), and genetic improve by using Johanson *et al.* (1955). Al Jibouri *et al.* (1958) advanced the correlation coefficient, and Dewy and Lu advanced course analysis (1959).

RESULTS AND DISCUSSION

The variance analysis confirmed giant differences between all characters (table 1). As a result, there may be a substantial diploma of range discovered within the twenty genotypes of chickpea.

Estimation of Genetic Parameters

Estimation of genetic parameters, correlation, and path analysis will be a useful resource in revealing the trends desirable for chickpea yield development selection. The genotypic variance (Vg) proven in Table 2 became phenotypic variance (Vp), genotypic coefficient of variation (GCV), phenotypic coefficient of version (PCV), heritability (bs) and genetic advance as a percent of implied genetic progress (GA percentage) proven in Table 2. The PCV values had been higher than the matching GCV values, displaying that the environment had an effect on the characters. The variety of pods in line with plant (23.97 and 22.26), seed output (21.99 and 18.30), and biological weight all had high PCV and GCV values (21. Fifty-five and 18.26). Jeena *et al.,* (2005), Arora and Jeena (2001), and Kumar et al., (2005) previously recorded excessive GCV for variety of pods according to plant and a hundred seed weight (2001). Among the parameters examined, the wide variety of seeds consistent with plant (1980) had the very best heritability, followed by means of the number of pods per plant (86.20), the wide variety of seeds consistent with pod (83. Ninety), the harvest index (eighty-three. 20), the 100 seed

weight (eighty-two.70), and the quantity of secondary branches (eighty-two. 60). (table2.). The excessive heritability values of the traits studied in this show that they were much less stimulated by the surroundings, which aids in the powerful selection of developments based totally on phenotypic expression the use of a simple selection system and indicates genetic improvement. Arora *et al*. Reported comparable findings (2018). Genetic progress aids in determining the actual growth anticipated through choice. Among the yield contributing variables studied in this study, strong genetic advance turned into recorded as a mean percentage for quantity of pods in keeping with plant (forty-two.58), followed via a wide variety of seeds consistent with plant (37. Sixty-two), 100 seed weight (32. Seventy-seven), and biological weight (31.87). (Table 2).

The presence of excessive heritability in addition to genetic progress for the parameters range of pods in line with plant, range of seeds in keeping with plant, and 100 seed weight advised that these characteristics were regulated by using additive gene consequences. As a result of the accumulation of in large part ruled by, direct choice of these developments primarily based on phenotypic expression using an easy choice approach would be green.

Estimation of Correlation Coefficient

The correlation between the trends turned into used to analyze the relationships between yield and yield contributing traits. Table three shows the behavioural and genotypic connections of twenty chickpea genotypes. The genotypical coefficient of correlation became identified as larger than the analogous phenotypical coefficient of correlation and showed a considerable diploma of genetic connection between trends. Flowers through 50% (0.424 and 0.269*) days, days to 50% pod setting (0.258 and 0.0497), plant height (0.321* and 0.259*), variety of number one branches (0.450** and 0.515**), range of secondary branches (0.300* and 0.268*) range of pods in line with plant (0.704** and 0.716**),range of seeds in step with plant (0.694** and 0.737**), Biological weight(0.716** and 0.674**), a hundred seed weight (0.275* and 0.392**), harvest index(0.375** and 0.399**) confirmed a fine reference to seed yield consistent with plant. While there are great terrible correlations among maturity days (-0.0954 and -0.267) and phenotypic degree and genotypic numbers of seed in keeping with pod (-0.0543 and-0.189). Ali *et al.,* (2011) and Qureshi *et al.* Have confirmed similar findings (2004).

Estimation of Path Coefficient

Table 4 displayed the outcomes of the direction analysis. Characteristics like range of number one branches, wide variety of pods per plant and variety of seeds every plant have been disclosed by effects.

A phenotypically and at genotypic level the biology weight, harvest index, discovered an instantaneous effect on seeding yield. Babbar and Patel (2005), Kuldeep *et al.* (2014), Naveed et al. (2012), and Tadesse *et al.* (2016) and Kumar *et al.* (2017) showed in advance studies on the direct effect on grain yields for biological yield and crop indices. In evaluation, Talebi *et al.,* (2007) have proven a favourable indirect impact

Table 1: Analysis of Variance for 13 Quantitative Characters of 21 Chickpea Genotypes during Rabi 2020-21.

Sr. no.	Source of Variations	Mean sum of squares		
		Replications (d.f=2)	Treatments (d.f=20)	Error (d.f=40)
1	Days to 50% Flowering	25.487	56.684 *	24.02
2	Days to 50% Pod Setting	23.545	18.008 *	7.625
3	Plant height (cm)	35.588	111.926 ***	11.51
4	No. of Primary Branches	0.119 *	0.234 ***	0.023
5	No. of Secondary Branches	1.086 *	3.203 ***	0.21
6	Days to maturity	30.174	56.860 *	24.093
7	No. of Pods per Plant	271.488 *	1036.698 ***	52.451
8	No. of Seeds Per Pod	0.018	0.128 ***	0.008
9	No. of Seeds Per Plant	158.095 **	934.822 ***	30.493
10	Biological Weight (g)	69.538 *	116.168 ***	13.459
11	100 Seed Weight (g)	1.981	23.069 ***	1.5
12	Harvest Index (%)	101.127 ***	102.719 ***	6.475
13	Seed yield per plant (g)	13.841 **	20.674 ***	2.668

*, **, *** indicates 5%,1% and 0.1% level of significance respectively

Table 2: Genetic Parameters for 13 Quantitative Characters of Chickpea Genotypes

S.no	Character	V_g	V_p	GCV	PCV	h^2 (bs)	GA	GA as % mean
1	Days to 50% flowering	10.89	34.91	3.53	6.31	31.20	3.80	4.06
2	Days to 50% pod setting	3.46	11.09	1.70	3.05	31.20	2.14	1.96
3	Plant height (cm)	33.47	44.98	10.43	12.09	74.40	10.28	18.53
4	No. of primary branches	0.07	0.09	11.03	12.71	75.30	0.47	19.70
5	No. of secondary branches	1.00	1.21	12.83	14.11	82.60	1.87	24.01
6	Days to maturity	10.92	35.02	2.37	4.24	31.20	3.80	2.73
7	No. of pods per plant	328.08	380.53	22.26	23.97	86.20	34.65	42.58
8	No. of seeds per pod	0.04	0.05	16.44	17.96	83.90	0.38	31.02
9	No. of seeds per plant	301.44	331.94	19.17	20.11	90.80	34.08	37.62
10	Biological weight (g)	34.24	47.70	18.26	21.55	71.80	10.21	31.87
11	100 seed weight (g)	7.19	8.69	17.49	19.23	82.70	5.02	32.77
12	Harvest index (%)	32.08	38.56	13.40	14.69	83.20	10.64	25.17
13	Seed yield per plant (g)	6.00	8.67	18.30	21.99	69.20	4.20	31.36

V_g =genetic variance; V_p =phenotypic variance; GCV = genotypic coefficient of variation; PCV = phenotypic coefficient of variation; h^2(bs) = heritability broad sense; GA = Genetic advance

Table 3: Phenotypic and Genotypic Correlation Coefficient for Yield Contributing Characters of Chickpea

		Days to 50% Flowering	Days to 50% Pod Setting	Plant height	No. of Primary Branches	No. of Secondary Branches	Days to maturity	No. of Pods per Plant	No. of Seeds Per Pod	No. of Seeds Per Plant	Biological Weight	100 Seed Weight	Harvest Index (%)	Seed yield per plant
Days to 50% Flowering	P	1	0.5023***	-0.0675	0.1847	0.2033	-0.0145	0.2018	0.0015	0.2599*	-0.0631	-0.3114*	0.1167	0.0424
	G	1	0.941**	-0.1145	0.441**	0.616**	-0.669**	0.467**	0.0862	0.564**	-0.04	-0.710**	0.291*	0.269*
Days to 50% Pod Setting	P		1	0.0837	0.1876	0.3284 **	0.2288	0.2926	-0.0423	0.2156	0.19	-0.1902	-0.2866*	0.0258
	G		1	0.0221	0.496**	0.627**	0.0433	0.529**	-0.1367	0.472**	0.182	-0.697**	-0.309*	0.0497
Plant height (cm)	P			1	0.1238	-0.132	0.4291	0.0967	0.2357	0.1913	0.5671	0.3044 *	-0.3316**	0.321*
	G			1	0.1203	-0.275*	0.657**	0.0277	0.1865	0.1929	0.700**	0.436**	-0.505**	0.259*
No. of Primary Branches	P				1	0.3831 **	-0.0823	0.6440***	-0.3465**	0.4082***	0.4115 ***	-0.1187	-0.0135	0.450**
	G				1	0.484**	-0.0668	0.755**	-0.401**	0.472**	0.490**	-0.1301	-0.0556	0.515**
No. of Secondary Branches	P					1	-0.1848	0.4328***	-0.1214	0.4305***	0.2731 *	-0.2226	-0.0139	0.300*
	G					1	-0.364**	0.460**	-0.2335	0.444**	0.244	-0.2237	-0.0115	0.268*
Days to maturity	P						1	-0.1447	0.169	-0.0938	0.2863 *	0.2059	-0.5024	-0.0954
	G						1	-0.364**	0.250*	-0.2107	0.561**	0.445**	-0.940**	-0.267*
No. of Pods per Plant	P							1	-0.2031	0.8133***	0.5611 ***	-0.2174	0.1291	0.704**
	G							1	-0.278*	0.827**	0.528**	-0.261*	0.1515	0.716**
No. of Seeds Per Pod	P								1	0.2570*	-0.0403	-0.164	0.0265	-0.0543
	G								1	0.2331	-0.131	-0.1332	0.0193	-0.189
No. of Seeds Per Plant	P									1	0.5346 ***	-0.2645*	0.1921	0.694**
	G									1	0.535**	-0.278*	0.2296	0.737**
Biological Weight (g)	P										1	0.4033**	-0.3609**	0.716**
	G										1	0.474**	-0.401**	0.674**
100 Seed Weight (g)	P											1	-0.0808	0.275*
	G											1	-0.049	0.392**
Harvest Index (%)	P												1	0.375**
	G												1	0.399**
Seed yield per plant (g)	P													1
	G													1

Table 4: Genotypic and Phenotypic Path Coefficient Analysis of 21 Chickpea Genotypes

		Days to 50% Flowering	Days to 50% Pod Setting	Plant height (cm)	No. of Primary Branches	No. of Secondary Branches	Days to maturity	No. of Pods per Plant	No. of Seeds Per Pod	No. of Seeds Per Plant	Biological Weight (g)	100 Seed Weight (g)	Harvest Index (%)	Seed yield per plant (g)
Days to 50% Flowering	G	**0.3419**	0.3218	-0.0391	0.1507	0.2105	-0.2287	0.1596	0.0295	0.1929	-0.014	-0.2427	0.0996	0.269*
	P	**-0.0265**	-0.0133	0.0018	-0.0049	-0.0054	0.0004	-0.0053	0	-0.0069	0.0017	0.0083	-0.0031	0.0424
Days to 50% Pod Setting	G	-0.0647	**-0.0687**	-0.0015	-0.0341	-0.0431	-0.003	-0.0363	0.0094	-0.0324	-0.013	0.0478	0.0212	0.0497
	P	0.0165	**0.0328**	0.0027	0.0061	0.0108	0.0075	0.0096	-0.0014	0.0071	0.0062	-0.0062	-0.0094	0.0258
Plant height (cm)	G	0.0282	-0.0054	**-0.2461**	-0.0296	0.0676	-0.1616	-0.0068	-0.0459	-0.0475	-0.172	-0.1073	0.1243	0.259*
	P	-0.0038	0.0048	**0.0568**	0.007	-0.0075	0.0244	0.0055	0.0134	0.0109	0.0322	0.0173	-0.0188	0.321*
No. of Primary Branches	G	-0.0686	-0.0773	-0.0187	**-0.1557**	-0.0753	0.0104	-0.1175	0.0624	-0.0734	-0.076	0.0203	0.0087	0.515**
	P	0.0027	0.0028	0.0018	**0.0147**	0.0056	-0.0012	0.0095	-0.0051	0.006	0.006	-0.0017	-0.0002	0.450**
No. of Secondary Branches	G	-0.0861	-0.0878	0.0384	-0.0677	**-0.1399**	0.0509	-0.0644	0.0327	-0.0622	-0.034	0.0313	0.0016	0.268*
	P	0.0051	0.0083	-0.0033	0.0096	**0.0252**	-0.0046	0.0109	-0.0031	0.0108	0.0069	-0.0056	-0.0003	0.300*
Days to maturity	G	0.0479	-0.0031	-0.047	0.0048	0.026	**-0.0716**	0.0261	-0.0179	0.0151	-0.04	-0.0319	0.0673	-0.267*
	P	-0.0001	0.0013	0.0024	-0.0005	-0.0011	**0.0057**	-0.0008	0.001	-0.0005	0.0016	0.0012	-0.0029	-0.0954
No. of Pods per Plant	G	0.1834	0.2077	0.0109	0.2965	0.1807	-0.1431	**0.3928**	-0.1094	0.3246	0.207	-0.1025	0.0595	0.716**
	P	0.0163	0.0236	0.0078	0.052	0.035	-0.0117	**0.0807**	-0.0164	0.0657	0.0453	-0.0176	0.0104	0.704**
No. of Seeds Per Pod	G	0.0192	-0.0305	0.0416	-0.0895	-0.0522	0.0559	-0.0622	**0.2233**	0.0521	-0.029	-0.0297	0.0043	-0.189
	P	0	0.001	-0.0055	0.008	0.0028	-0.0039	0.0047	**-0.0232**	-0.006	0.0009	0.0038	-0.0006	-0.0543
No. of Seeds Per Plant	G	-0.4598	-0.3851	-0.1573	-0.3844	-0.3622	0.1718	-0.6737	-0.19	**-0.8151**	-0.436	0.2266	-0.1872	0.737**
	P	-0.0094	-0.0078	-0.0069	-0.0147	-0.0155	0.0034	-0.0294	-0.0093	**-0.0361**	-0.0193	0.0095	-0.0069	0.694**
Biological Weight (g)	G	-0.0698	0.3142	1.2101	0.8474	0.4223	0.9704	0.913	-0.2261	0.9255	**1.729**	0.8201	-0.6936	0.674**
	P	-0.0578	0.1742	0.52	0.3773	0.2504	0.2625	0.5145	-0.037	0.4902	**0.9169**	0.3698	-0.3309	0.716**
100 Seed Weight (g)	G	0.1397	0.1371	-0.0858	0.0256	0.044	-0.0876	0.0514	0.0262	0.0547	-0.093	**-0.1967**	0.0096	0.392**
	P	0.0138	0.0085	-0.0135	0.0053	0.0099	-0.0091	0.0097	0.0073	0.0118	-0.0179	**-0.0444**	0.0036	0.275*
Harvest Index (%)	G	0.2574	-0.2732	-0.4464	-0.0491	-0.0101	-0.8306	0.1339	0.017	0.2029	-0.355	-0.0433	**0.8839**	0.399**
	P	0.0856	-0.2103	-0.2433	-0.0099	-0.0102	-0.3686	0.0947	0.0195	0.141	-0.2648	-0.0593	**0.7337**	0.375**
Seed yield per plant (g)	G	0.269*	0.0497	0.259*	0.515**	0.268*	-0.267*	0.716**	-0.1887	0.737**	0.674**	0.392**	0.399**	**1**
	P	0.0424	0.0258	0.321*	0.450**	0.300*	-0.0954	0.704**	-0.0543	0.694**	0.716**	0.275*	0.375**	**1**
Partial R:	G	0.0918	-0.0034	-0.0638	-0.0802	-0.0376	0.0191	0.2811	-0.0421	-0.6009	1.165	-0.0771	0.3528	
	P	-0.0011	0.0008	0.0182	0.0066	0.0075	-0.0005	0.0569	0.0013	-0.025	0.6563	-0.0122	0.2748	

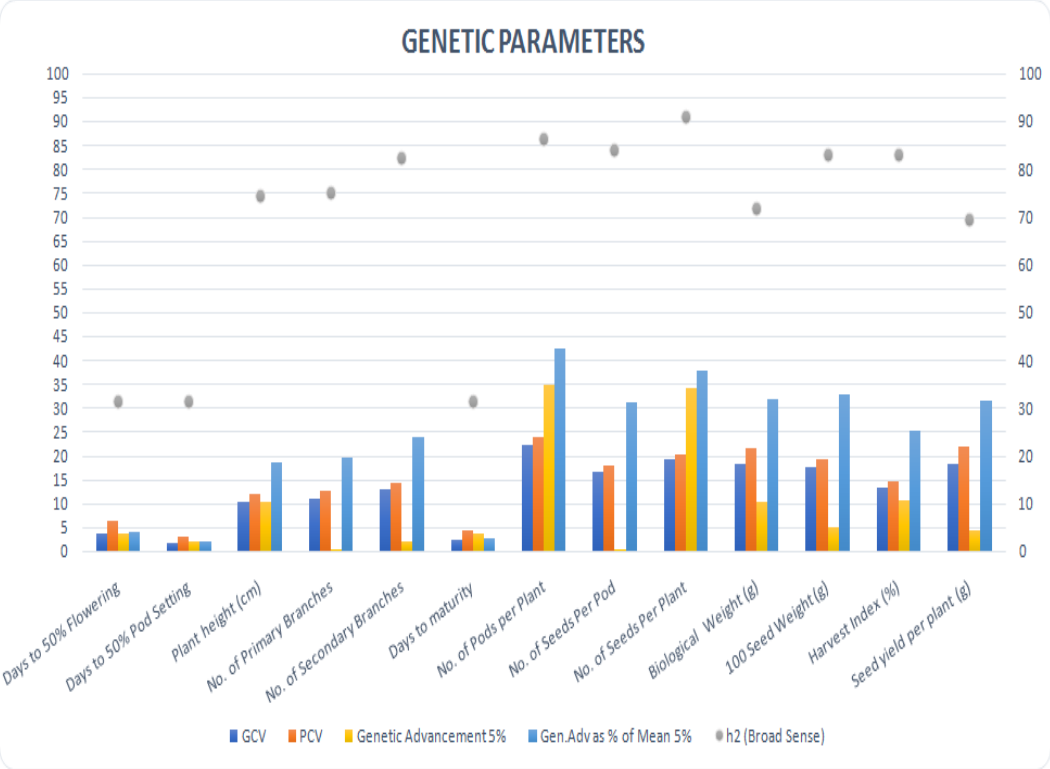

Figure 1: Histogram Depicting GCV, PCV, Genetic Advance and H2 for 13 Quantitative Characters of 21 Chickpea Genotypes

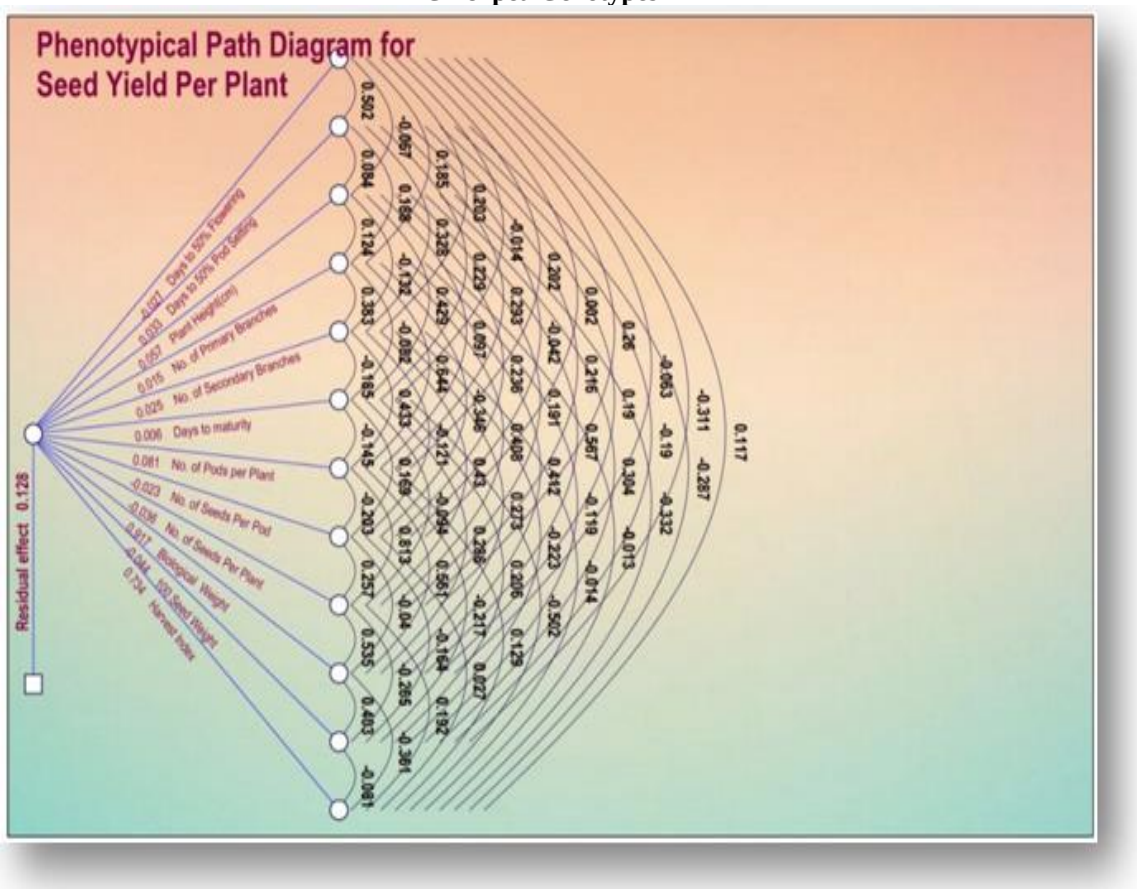

Figure 2: Phenotypic Path for Yield Contributing Traits of ChickPea

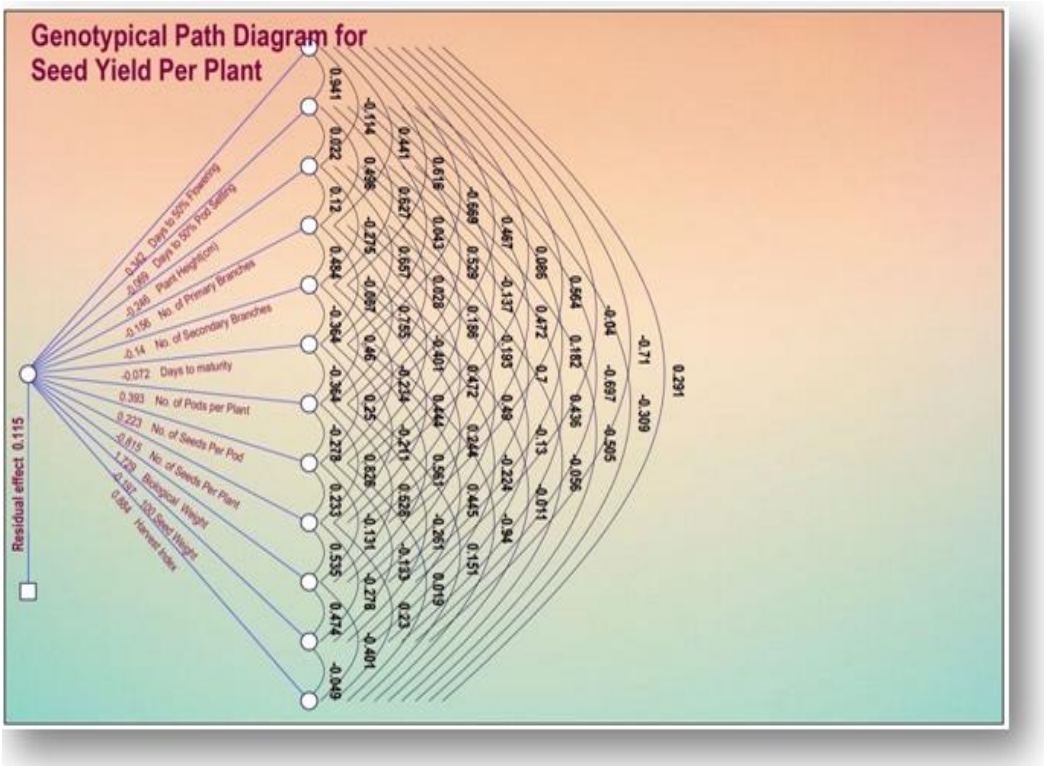

Figure 3: Genotypic Path for Yield Contributing Traits of Chickpea

CONCLUSIONS

In the cutting-edge look at Estimates of ANOVA, genetic parameters which includes a genotypic coefficient of variation and phenotypic coefficient of variation analysis confirmed that characters such as wide variety of pods in keeping with plant, quantity of seeds in keeping with plant, seed weight and harvest index, quantity of primary branches have been extra reliable for yield improvement. These qualities were given the maximum priority whilst choosing chickpea to improve the yield.

REFERENCES

1. *Afsari Sharif Qureshi, Anila Shaukat, A. Bakhsh, M. Arshad and A. Ghafoor (2004). An assessment of variability for economically important traits, pak. J. Bot., 36(4): 779-785,2004.*
2. *A. I. Saki, M. A. Zaman, M. Tuhina-Khatun, M.M. Kamal and Hasina Begum(2009), Genetic Variability, Correlation and path-coefficient Analysis for Agronomic Traits in chickpea, A Scientific Journal of Krishi Foundation., 7(1&2):12-21.*
3. *Arora, P.P. and Jeena, A.S. (2001). Genetic variability studies in chickpea. Legume Research-An International Journal. 24(2):137-138.*
4. *Babbar, A. and Patel, S.K. (2005). Correlation and Path analysis in desi chickpea under Kymore plateau zone of Madhya Pradesh. JNKVV Research Journal, 39(1): 47-51.*
5. *Derya ozveren yuceli, Adem Emin anlarsal, Celal yucel (2006). Genetic Variability, Correlation and path analysis of yield, and yield components in chickpea, turk J agri.,183-188.*
6. *Jeena, A.S., Arora, P.S. and Ojha, O.P. (2005). Variability and correlation studies for yield and its components in chickpea. Legume Research. 28(2):146-148.*

7. *Kuldeep, R.K., Pandey, S., Babbar, A. and Mishra, D.K. (2014). Genetic variability, character association and path coefficient analysis in chickpea grown under heat stress condition. Electronic Journal of Plant Breeding. 5(4):812-819.*

8. *Kumar, S., Kumar, A., Kumar, A., Kumar, R.R., Roy, R.K. and Agrawal, T. (2017). Genetic Variability of Chickpea Genotypes under Heat Stress Condition: Character Association and Path Coefficient Based Analysis. Indian Journal of Ecology. 44 (Special Issue-4): 59-64.*

9. *M. T. Hasan, A. C. Deb(2017). Assessment of Genetic Variability, heritability, character association, Department of botany, government Akbar Ali college, Ullapara, Sirajgonj, Bangladesh.*

10. *Naveed, M., Shafiq, M., Rafiq, C.M. and Zahid, M.A. (2015). Genetic diversity in new chickpea accessions for fusarium wilt resistance, canopy temperature and yield components under drought milieus. Australian Journal of Crop Science. 9(6):538-544.*

11. *Qurban ali, Muhammad Ahsan and Jehanzeb Farooq(2010). Genetic Variability and trait association in chickpea,1(3):334-341*

12. *Qurban Ali, Muhammad Hammad Nadeem Tahir, Hafeez Ahmad Sadaqat, Saeed Harshad, Jahenzeb Farooq, Muhammad Ahsan, Muhammad Waseem and Amjad Iqbal(2011). Genetic variability and correlation analysis of quantitative traits in chickpea genotypes, Journal of Bacteriology Research.,vol.3(1), pp.6-9.*

13. *Qurban Ali,M.Waseem, M.Sadique(2011).Genetic Variability for grain yield,2011:201-208.*

14. *R. N Arora, Krishan Kumar and Manav(2018).Genetic Variability studies for yield contributing traits in chickpea, Journal of Pharmacognosy and Phytochemistry.,7(2):2675-2677.*

15. *Shahid Riaz Malik, Ahmad Bakhsh, M.Ahsan Asif,Umer Iqbal and S.M.Iqbal(2009).Assessment of genetic variability,12-1-81-85.*

16. *Shanmugham Mohan and Kalaimagal Thiyagarajan(2019).Genetic variability,Correlation 8(5):1801-1808*

17. *Talebi, R., Fayaz, F. and Jelodar, N.A.B. (2007). Correlation and path coefficient analysis of yield and yield components of chickpea (Cicer arietinum L.) under dry land condition in the west of Iran. Asian Journal of Plant Science. 6(7):1151-1154.*

18. *Tadesse M, Fikre A, Eshete M, Girman N, Korbun L, Mohamed R, Bekele D, Funga A and Ojiewo, C.O. (2016). Correlation and path coefficient analysis for various quantitative traits in desi chickpea genotypes under rainfed conditions in Ethiopia. J. of Agri. Sci., 8(12):11*